

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**WORK INTEGRATED LEARNING PROGRAMMES**

**COURSE HANDOUT**

**Part A: Content Design**

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| **Course Title** | Software Quality Assurance and Testing |
| **Course No(s)** | SE ZG501 |
| **Credit Units** | 4 |
| **Course Author** | Bhaskar Zeminder |
| **Version No** | 1.0 |
| **Instructor –in-Charge** | Rajesh S |
| **Date** | 29- July-2023 |

**Course Objectives**

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| **No** | Objective |
| **CO1** | Develop a comprehensive understanding of software quality assurance principles, methodologies, and industry best practices to ensure the delivery of high-quality software products |
| **CO2** | Master the various techniques and tools used in software testing, verification, and validation to effectively identify and rectify defects throughout the software development lifecycle. |
| **CO3** | Analyse and apply advanced quality assurance strategies such as test automation, continuous integration, and agile testing, to enhance the efficiency and effectiveness of software development teams in delivering top-notch software products |

**Textbook(s)**

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| --- | --- |
| T1 | Software Quality Assurance Book by Alain April and Claude Y. Laporte |
| T2 | Software Quality Assurance (From Theory to Implementation) by Daniel Galin |

**Reference Book(s) & other resources**

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| --- | --- |
| R1 | Software Quality Assurance By Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan |
| R2 | Software Testing: Concepts and Operations by Rajiv Chopra |
| R3 | Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, Wiley, 2013 |
| R4 | Software Quality Engineering – Jeff Tian, Wiley India, 2015 |
| R5 | Quality Planning and Assurance Book by Herman Tang |

**Content Structure**

**Module 1: Essential SQA: Processes and Success Factors**

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| Topic No. | Topic Title | Reference |
| 1.1 | Definition and importance of software quality assurance | T1 Chapter 1 |
| 1.2 | Distinction between Quality Assurance and Quality Control | Lecture Notes |
| 1.3 | Success Factors in Quality Assurance | T1 Chapter 1 & T2 Chapter 1 |
| 1.4 | Cost of Quality and Quality Culture | T1 Chapter 2 |
| 1.5 | Role of SQA in software development life cycle | Lecture Notes |

**Module 2: Standardizing SQA: Quality Models and Management**

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| Topic No. | Topic Title | Reference |
| 2.1 | Software Quality Models | T1 Chapter 3, R1 Chapter 2 |
| 2.2 | Specifying Quality Requirements and Plan | T1 Chapter 3 |
| 2.3 | Requirement Traceability During Software Lifecycle | T1 Chapter 3 |
| 2.4 | Standards for Quality Management | T1 Chapter 4 |
| 2.5 | Frameworks (ITIL, ISO, CMMi) | T1 Chapter 4 |

**Module 3: Fundamentals of SQA: Software Quality Attributes**

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| Topic No. | Topic Title | Reference |
| 3.1 | Software Requirements into Software Quality Factors | T2 Chapter 3 |
| 3.2 | Understanding quality attributes   * Reliability * Usability * Maintainability * Other quality attributes | T2 Chapter 3, R1 Chapter 2 |
| 3.3 | Alternative models of Software Quality Factors | T2 Chapter 3 |

**Module 4: Deep driving SQA: Software Testing Techniques**

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| Topic No. | Topic Title | Reference |
| 4.1 | Software Testing Fundamentals | T2 Chapter 9, R2 Chapter 1 |
| 4.2 | Software Verification and Validation | R2 Chapter 2 |
| 4.3 | Test design techniques (black-box testing, white-box testing, boundary value analysis, equivalence partitioning, etc.) | R2 Chapter 3 & 4 |
| 4.4 | Test levels and types (unit testing, integration testing, system testing, etc.) | R2 Chapter 7 |

**Module 5: Mastering SQA: Test Execution and Automated Testing**

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| Topic No. | Topic Title | Reference |
| 5.1 | Test Execution Process | T2 Chapter 10 |
| 5.2 | Test Case Design | T2 Chapter 10 |
| 5.3 | Automated testing | T2 Chapter 10, R2 Chapter 9 |
| 5.4 | Alpha and Beta site testing programs | T2 Chapter 10 |
| 5.5 | Regression Testing Strategies | R2 Chapter 6, R2 Chapter 12 |
| 5.6 | Case Study: Exploring Automated Source Code Analyzers and Software Composition Analysis Tools | Lecture Notes |

**Module 6: Effective SQA: Quality Audits and Project Assessments**

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| Topic No. | Topic Title | Reference |
| 6.1 | Personal Review, Inspection Review and Project Assessments | T1 Chapter 5, T2 Chapter 8 |
| 6.2 | Types of Audits (Internal, Third Party) | T1 Chapter 6 |
| 6.3 | Project Assessment and Control Process | T1 Chapter 6, T2 Chapter 8 |
| 6.4 | Corrective Actions | T1 Chapter 8 |

**Module 7: Comprehensive SQA: Effective Test Management and Planning**

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| Topic No. | Topic Title | Reference |
| 7.1 | Test Organization and Team Management | T1 Chapter 5 |
| 7.2 | Test Estimation and Scheduling | R1 Chapter 7 |
| 7.3 | Test Data Management | Lecture Notes |
| 7.4 | Configuration Management and Change Control | T1 Chapter 8, T1 Chapter 5 |
| 7.5 | Case Study: Develop a test plan and design test cases for a given software application | Lecture Notes |

**Module 8: Enhancing SQA: Process Improvement and Metrics**

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| Topic No. | Topic Title | Reference |
| 8.1 | Introduction to Test Process Improvement | T1 Chapter 9 |
| 8.2 | Capability Maturity Model Integration (CMMI) for Testing | T1 Chapter 10 |
| 8.3 | Six Sigma in Software Testing | Lecture Notes |
| 8.4 | Test Metrics for Process Improvement | T2 Chapter 21 |

**Module 9: Optimizing SQA: Agile Testing and DevOps Integration**

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| Topic No. | Topic Title | Reference |
| 9.1 | Introduction to Agile Methodology and Testing | T1 Chapter 4 |
| 9.2 | Agile Test Planning and Execution | T1 Chapter 5 |
| 9.3 | Continuous Testing in DevOps | Lecture Notes |
| 9.4 | Test Environment and Test Data Management in DevOps | Lecture Notes |

**Module 10: Excelling SQA: Best Practices and Case Studies**

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| Topic No. | Topic Title | Reference |
| 10.1 | Best Practices for SQA implementation | T1 Chapter 4, Lecture Notes |
| 10.2 | Quality assurance in different development methodologies (Waterfall, Agile, etc.) | T2 Chapter 7 |
| 10.3 | Building a quality culture in organizations | R1 Chapter 7 |
| 10.4 | Case studies of successful SQA implementations | Lecture Notes |
| 10.5 | Lessons learned from successful software quality assurance projects | Lecture Notes |

**Module 11: Shaping SQA: An Outlook for the Future**

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| Topic No. | Topic Title | Reference |
| 11.1 | Emerging technologies and their impact on SQA | Lecture Notes |
| 11.2 | Artificial intelligence and machine learning in quality assurance | Lecture Notes |
| 11.3 | Blockchain and quality assurance | Lecture Notes |
| 11.4 | Future directions and career opportunities in SQA | Lecture Notes |

**Learning Outcomes:**

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| --- | --- | --- |
| No | Learning Outcomes | Objectives |
| LO1 | Advanced knowledge of Software Quality Assurance principles and methodologies | By the end of the course, participants should have an in-depth understanding of the advanced principles, concepts, and methodologies of Software Quality Assurance. They should be well-versed in topics like quality models, process improvement frameworks (e.g., CMMI, Six Sigma), risk management, and the application of SQA in different software development models (e.g., Agile, DevOps). |
| LO2 | Master testing techniques and tools for comprehensive software testing. | Upon completing the course, participants should have a solid knowledge of various testing techniques, such as unit testing, integration testing, system testing, and acceptance testing. They should also be proficient in using popular testing tools and frameworks to create, execute, and analyse test cases effectively, ensuring comprehensive test coverage and defect detection. |
| LO3 | Proficiency in designing and implementing robust quality assurance strategies | Upon completing the course, participants should be capable of developing comprehensive and effective quality assurance strategies tailored to specific software projects. They should be skilled in devising test plans, defining test cases, and establishing quality metrics to measure the performance and reliability of software applications across different domains and industries. |

**Part B: Contact Session Plan**

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| **Academic Term** | First Semester 2024-2025 |
| **Course Title** | Software Quality Assurance and Testing |
| **Course No** | SE ZG501 |
| **Lead Instructor** | Rajesh S |

**Teaching Methodology *(Online Session Mode)***

The pedagogy for this course is centred around online contact sessions, which consist of 2-hour lecture sessions. In addition to the delivery of lessons on the topics, these contact sessions will also be enriched with discussions on organization-specific practices and case studies from experienced QA managers in the Indian IT industry.

**Course Delivery**

* There are 16 Contact Sessions (of 2 hours each)—8 before mid-semester and 8 post-mid-semester over a period of 16 weeks
* The 8th & 16th Contact Sessions are planned for review of topics pre-mid-semester and pre-comprehensive examinations.

**Course Contents**

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| --- | --- |
| **Contact Session** | **List of Topic Title** |
| 1 | Module 1: Essential SQA: Processes and Success Factors |
| 2 | Module 2: Standardising SQA: Quality Models and Management |
| 3-4 | Module 3: Fundamentals of SQA: Software Quality Attributes |
| 5 | Module 4: Deep driving SQA: Software Testing Techniques |
| 6-7 | Module 5: Mastering SQA: Test Execution and Automated Testing |
| 8 | **Review of Contact Session Topics (1 to 7) for Mid-Sem Examination** |
| 9 | Module 6: Effective SQA: Quality Audits and Project Assessments |
| 10-11 | Module 7: Comprehensive SQA: Effective Test Management and Planning |
| 12 | Module 8: Enhancing SQA: Process Improvement and Metrics |
| 13 | Module 9: Optimizing SQA: Agile Testing and DevOps Integration |
| 14 | Module 10: Excelling SQA: Best Practices and Case Studies |
| 15 | Module 11: Shaping SQA: An Outlook for the Future |
| 16 | **Review of All Topics for Comprehensive Examination** |

**Assignments**

Each participant or Group of participants will be given an assignment on a topic that was discussed in class. The assignment topics will be based on practical problems experienced or part of work items or tools used by collaborating organizations.

* Assignments will be take-home and deadline-driven, typically lasting 2 weeks. Participants are expected to spend at least 16 hours on the study, research, discussion, and preparation of the report and presentation.
* As part of the deliverables, participants will prepare a report and/or make a short presentation in class.

**Experiential Learning Components**

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| **No** | **Topic** | **Objectives** | **Hands-On-Exercises** |
| 1 | SQA Planning and Design | Learn how to create a comprehensive test plan and design effective test cases. | Develop a test plan and design test cases for a given software application. |
| 2 | Automation Frameworks | Introduction to automation tools and frameworks | Automate test cases using a popular test automation tool. |
| 3 | Usability Testing | Understand the importance of user experience and usability in software. | Conduct usability testing on a software interface and provide recommendations for improvement. |
| 4 | Continuous Integration and Continuous Testing | Explore the concepts of continuous integration and continuous testing in SQA | Demonstration of CI/CD pipeline and automate the testing process for a software application. |

**Evaluation Scheme:**

**Legend:** EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

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| --- | --- | --- | --- | --- | --- |
| Evaluation Component | Name  (Quiz, Lab, Project, Mid-term exam, End semester exam, etc.) | Type (Open book, Closed book, Online, etc.) | Weight | Duration | Day, Date, Session, Time |
| EC - 1 | Quiz-I/ Assignment-I | Online | 7.5% |  | September 1-10, 2024 |
| Quiz-II | Online | 7.5% |  | October 10-20, 2024 |
| Quiz-III/ Assignment-II | Online | 15% |  | November 1-10, 2024 |
| EC - 2 | Mid-sem | Closed book | 30% | 2 hours | Friday, 20/09/2024 (AN) |
| EC - 3 | Comprehensive | Open book | 40% | 2 ½ hours | Friday, 29/11/2024 (AN) |

**Note: If Assignment kindly remove Quiz-I, II, III**

Syllabus for Mid-Semester Test (Closed Book): Topics in Contact Hours: 1 to 8

Syllabus for Comprehensive Exam (Open Book): All topics

Important links and information:

Elearn portal: https://elearn.bits-pilani.ac.in

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Contact sessions: Students should attend the online lectures as per the schedule provided on the Elearn portal.

Evaluation Guidelines:

1. EC-1 consists of either two Assignments or three Quizzes. Students will attempt them through the course pages on the Elearn portal. Announcements will be made on the portal, in a timely manner.
2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.

**Instructor-in-charge**